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(54) Breaker core for feeder

The invention involves a breaker core for a feeder in which the core is preferably in the shape of a circular disc with a central hole of small diameter and made from a material that will hold its shape at the temperature of molten metal as it is poured, and possibly containing a binding agent, and possibly covered with a coating, and where the breaker core has sheet metal reinforcement plate (18) on its inner face and a coating (22, 22a) on its outer face. Preferably the sheet (18) consists of an unalloyed iron plate.

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Patent claims

1. A breaker core for a feeder in which the core is preferably in the shape of a circular disc with a central hole of small diameter and made from a material that will hold its shape at the temperature of molten metal as it is poured. and possibly containing a binding agent. and possibly covered with a coating. **characterised in that** the breaker core has sheet metal reinforcement (**18**) on its inner face and a coating (**22, 22a**) on its outer face.
2. A breaker core according to claim 1, characterised in that the plate (**18**) consists of a thin iron sheet with a thin coating (**22, 22a**) on its outer face.
3. A breaker core according to claim 2, characterised in that the plate (**18**) consists of an unalloyed iron sheet.
4. A breaker core according to claim 1. characterised in that the ratio of the diameter of the plate to the thickness of the plate is from 100 to 0.2 up to 2.
5. A breaker core according to claim 4, characterised in that the ratio of the diameter of the plate to the thickness of the plate is from 100 to 0.6 up to 1.
6. A breaker core according to claim 1, characterised in that the diameter of the gate aperture (**19**) to the diameter of the breaker core is in the ratio of 100 to 6 up to 12.
7. A breaker core according to claim 6, characterised in that the diameter of the gate aperture (**19**) to the diameter of the breaker core is in the ratio of 100 to 8 up to 10.
8. A breaker core according to claim 1 and one or more of the claims 2 to 7. characterised in that the metal plate (**18**) is provided with a non-metallic coating (**22**) on its side facing the casting and / or on its side facing the feeder (**17**).
9. A breaker core according to claim 1, characterised in that the coating (**22, 22a**) consists of an inorganic. fireproof material.
10. A breaker core according to claim 1. characterised in that the coating (**22, 22a**) consists of an organic material.
11. A breaker core according to claim 12. characterised in that the coating (**22, 22a**) consists of a plastic.
12. A breaker core according to claim 1. characterised in that the thickness of the coating (**22, 22a**) is of the same order of magnitude as the thickness of the metal plate.
13. A breaker core according to claim 1, characterised in that two or more thin plates are present. between which there is a thin layer.
14. A breaker core according to claim 15. characterised in that the thin layer between two plates (**18, 18a**) consists of a plastic foil.
15. A breaker core according to claim 1. characterised in that the layer consists of a foam plastic (**23**).
16. A breaker core according to claim 15. characterised in that the layer consisting of a foam plastic is arranged on the side facing the feeder (**17**) and the annular-shaped foam plastic layer

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forms a connecting element with the internal wall of a hollow feeder (**17**).
17. A breaker core according to claim 1. characterised in that attachment tabs (**21**) are arranged on the circumference of the plate (**18**).
18. A breaker core according to claim 1. characterised in that. while keeping the thickness of the plate (**18**) constant across its diameter. the aperture (**19**) is arranged as a gate aperture at a small distance above the level of the greater surface of the breaker core.
19. A breaker core according to claim 17. characterised in that the plate (**18**) is domed in a spherical shell shape over its entire diameter.
20. A breaker core according to claim 18. characterised in that the plate (**18**) is domed in the immediate vicinity of its gate aperture (**19**) towards the feeder (**17**).
21. A breaker core according to claim 13, characterised in that an exothermic layer (**21**) is present between the plates (**18, 18a**).

Description

It is a well-known practice in casting to arrange a reservoir, known as a feeder, riser, lost header or casting head. for molten metal to compensate for the reduction in volume as the casting sets, thus preventing shrinkage in the casting. This is of particular importance when there are relatively thick cross sections in the casting which can be subject to shrinkage. Small thin-walled castings are less prone to shrinkage since the pouring flow has a compacting effect.

Normally the feeder is arranged at about the height of the gate and, furthermore, is provided with a thermal insulating material or exothermic materials so that the molten metal in the feeder hardens later than the casting itself. After hardening. the feeder remains attached to the casting and has to be separated from it. Then the top surface of the casting must be deburred and smoothed. This is a labour-intensive and relatively expensive operation which can lead to damage to the top surface of the casting where it joins the feeder. Often. to limit damage of this kind and to make it easier to separate the feeder. a breaker core (known also as a breaker edge. sand strip or knock-off feeder) is provided.

The breaker core is located between the feeder and the casting mould. It is essentially disk-shaped with a round. polygonal or oval profile with an aperture large enough to allow the molten metal to continue flowing into the shrinkage cavities but smaller than the diameter of the feeder. This minimises the web joining the feeder to the casting. making it easier to mill. cut. burn or break off the feeder. As a result. the effort required to deburr and smooth the upper surface of the casting is reduced.

The breaker cores known in the practice are made from conventional casting materials using binding agents. such as silica. zircon. or chromite sand which are combined with oils. cereal binders. water glass or phenolic resins.

Breaker cores made from siliceous ceramic material have been used before also.

One disadvantage of these known breaker cores is their comparatively low strength. Therefore, in order to cope with the considerable pressures caused by the flow of metal between feeder and mould and so as not to bend or break during the feeding process, they have to be made with thick walls.

Furthermore, these known breaker cores will only allow a certain minimum aperture diameter corresponding to about a half of the diameter of the feeder nearest the casting. If smaller diameters are used, the molten metal hardens prematurely and in the aperture, resulting in an insufficient flow of the molten metal out of the feeder. Due to these large feeding apertures, the web between feeder and casting remains so large that the costs for parting the feeder and smoothing the top surface of the casting still remain exceptionally high. The intended improvement is therefore only slight. To resolve the drawbacks mentioned above, it is proposed in DE-OS 32 16 185, already published, that the material used for the breaker core has a thermal conductivity of at least 10 W/ m • K (at 20°C). This should allow the aperture diameter of the breaker core to be reduced to about 5% of the internal diameter of the feeder. In turn, this would facilitate separation of the feeder.

It was further proposed that the thermally conductive materials would take the form of a dense solid material or highly compacted particles. The term "highly compacted" would mean particles compacted under high pressure, sintered or transformed with or without a binding agent and would be of a suitable powdery structure or would contain a proportion of flour sufficient to inhibit large pore cavities.

Examples of dense solid materials are heat-resistant metals, particularly alloys such as chrome nickel steels, chrome steels, tungsten steels, monel metal and the like, but also hard metals such as the WC-Co and WC-TiC-Co types, and those substances that have come to be known as "cermets", such as $FeAl_2O_3$ cermets with 40-60% Fe. Breaker cores made from these materials can have thermal conductivities up in the region of about 60 W/ m • K. They are extremely strong and can therefore be kept particularly thin. They can be planed appropriately and formed as two-part components so that they can be removed undamaged after dressing, and reused.

The selection of examples for highly compacted particulate materials includes the group of hard substances like carbides (e.g. silicium carbide, titanium carbide or tungsten carbide), nitrides (e.g. zirconium nitride or aluminium nitride), borides and silicides. When sintered hard materials are used, the breaker cores made from them should be produced, again, as two-part components. It is not absolutely necessary to use sintering, however. Very good results have been obtained, for example, with compacted silicium carbide with grey cast iron. However, SiC cannot be used for steel casting due to the risk of carburising and siliconising the steel.

According to the DE-OS cited above, graphite, which can have values up to 400 W/ m • K, is also a thermally conductive material. However, in its pure form, graphite is unsuitable for the purposes of this invention since it is not strong enough (shape stability). However, graphite is ideal as a supplement to materials that do not have sufficient inherent thermally conductivity to provide a material with the thermal properties required for this invention. For example, a compacted mixture of bentonite with 20-80% by weight of graphite additive can produce very good breaker cores which can even be used, if necessary, for steel casting at low graphite contents and properly dimensioned. Another example is a transformed mixture of 60% by weight of graphite and 40% by weight of zirconium flour, bonded with phenol resol (cold-hardened with acid). Substances other than graphite can be used, however, particularly metal chips and swarf as highly thermal conductive additives to materials not having sufficient inherent thermally conductivity.

The heat resistant and reusable materials used in the DE-OS cited above are expensive and, as highly compacted, particulate materials, can be used only for small diameters, up to about 10 cm. A knock-off core produced by this proposal would be 5 mm thick with a diameter of 70 mm and a central gate aperture of 12 mm in diameter.

The invention proposed here is intended to produce a breaker core for single use only which is cost-effective, reliable and versatile to use.

This task is resolved by using a breaker core for a feeder in which the core is preferably in the shape of a flat disc with a central hole of small diameter and made from a material that will hold its shape at the temperature of molten metal as it is poured, and possibly containing a binding agent, and possibly covered with a coating, and with the inventive step that the breaker core has a sheet metal plate or metal mesh as reinforcement on its inner face and a coating on its outer face.

The beaker core made according to the invention is very cost-effective to make and, formed as a thin-walled part, is very reliable in use because the reinforcement, made from wire mesh or preferably a sheet, with a thin-walled construction, fulfils the requirements for high strength and cannot break. The reinforcement, made in sheet form, is an excellent carrier for the coating which is fire-resistant and able to withstand the metal being poured. Thus, this coating can consist of inorganic materials, especially ceramic types, in layer form, or also organic substances such as paints or plastics which form lustrous carbon under the effect of the molten metal.

It is particularly advantageous to make the plate out of thin sheet iron with an outer thin coating..

It is particularly advantageous if the diameter of the plate to its thickness is 100 to 0.2 to 2, and especially 100 to 0.6 to 1.0. With a plate diameter of 10 cm, this provides a preferred wall thickness below 1 mm. Since this plate carries the coating, in most cases the coating is of the same order of magnitude as the plate thickness. It is better to make the coating thinner than the plate because the latter's task is to provide the strength, while the coating's task is to act as a

separation layer between plate and molten metal. The plate and its coating can be very thin, therefore. The benefit of this is that the ability of the breaker core to dissipate heat is so small that it has practically no quenching effect on the molten metal and, thus, does not hamper dense feeding.

The proposal to produce a breaker core essentially out of a sheet formed by rolling allows for very thin-walled, high-strength plates. The plate can be adapted to the type of casting being poured. Where the casting is being made in a steel alloy, this plate should be made of iron. Where the casting is being made in an aluminium alloy, it is preferable if this plate is made from aluminium sheet. However, it is also possible to use an iron plate with an aluminium casting, or one from an alloy which is compatible with aluminium and has a higher melting point than aluminium.

It is particularly beneficial if the plate is made in iron, that is, an unalloyed iron of commercial quality as used customarily in the trade. Therefore, the sheet used can be made from an unalloyed iron material such as ST 37 quality sheet iron. This means that the plate within the meaning of the definition stated in or meant by DE-OS 32 16 185 is not inherently heat resistant.

The plate-shaped breaker core according to the invention has a wall thickness of from 0.2 to 2 mm. Within this range, the wall thickness depends on the diameter of the breaker core because the plate can be very strong, can be very large and, therefore, can have a diameter of 20 to 40 cm even with large castings. Large diameters like this will allow for a wall thickness of 2 mm.

In the case of moulds made conventionally for mass production, particularly those made on mould machines, the plate can have a wall thickness of 0.4 to 1 mm, and preferably 0.6 mm.

As mentioned above, the breaker core of thin sheet, particularly in unalloyed steel sheet, has a diameter normal for knock-off cores, but also a diameter of a size not before usable as a breaker core due to the effect of the sudden heating caused by the molten metal.

The design of the breaker core according to the invention has a gate aperture with a diameter of 0.5 to 2 cm. If the diameter of the breaker core is between 3 and 10 cm, the diameter of the gate aperture is about 6 to 10 mm, preferably 5 mm.

In some cases, depending on the type of metal being poured, the plate can form the knock-off core, having been bright rolled while rolling its surface, or its surface can be coated to prevent corrosion. These thin coatings are effective in innumerable cases within the meaning of this invention.

It is also possible to provide one or both sides of an unalloyed iron plate with a thin metal layer of a high melting point metal, such as by galvanising. It is

particularly beneficial to provide, on the side facing the casting or on the side facing the feeder or on both sides, a non-metallic coating which can consist of an inorganic fireproof substance or an organic substance.

The coating made from an inorganic material can be a fireproof substance, as is known generally for layers, such as zirconium flour. However, it can also be an enamel coating.

The proposal made for the invention to form the breaker core from a metal sheet makes it possible to apply highly resistant coatings which are applied to a heated plate as sintered layers and are very stable as a consequence.

The coating can also consist of a plastic, such as a plastic paint. This coating does not simply provide the benefit of protecting a breaker core made from sheet iron from corrosion, but a plastic coating gives the added advantage that, under the effect of the heat of the molten metal of over 800°C and the neutral atmosphere in the mould, the plastic deposits on the iron plate as lustrous carbon with the heat from the molten metal, thereby providing insulation from the molten metal. The plastic coating of the breaker core made from sheet, preferably sheet iron, thus transforms into a highly fireproof layer under the effect of the heat of the molten metal.

This effect just described can also be achieved if the coating consists of foam plastic.

A layer of foam plastic on the side towards the feeder offers the additional advantage that the foam plastic, present in a appropriate thickness, acts as a connecting element to the inner wall of a feeder designed as a hollow body. This is particularly beneficial because, in the case of machine-formed casting moulds when using cylindrical feeder inserts, particularly those with exothermically reacting substances, a mandrel is present in the interior of the feeder during the forming of the casting mould which takes up the pressure on the feeder, thus protecting it from damage.

The proposal to deposit a layer of foam plastic on the thin sheet breaker core on its side towards the feeder makes it possible, using comparatively simple means, to attach the breaker core afterwards to the preformed feeder after producing the mould.

The attachment to a preformed feeder inserted into the mould can be done by stamping out attachment tabs on the circumference of the plate.

In a further design, according to the invention, it is proposed that, while keeping the thickness of the breaker core the same over its diameter, the aperture is arranged as a gate face at a slight distance above the plane of the main surface of the gate. This proposal ensures that, when knocking off the feeder attached to the casting, no recess remains, as a result of the striking action, in the casting needed later. This desired effect can be achieved by doming the breaker

core over its entire diameter in the shape of a domed shell, or the breaker core can be domed towards the feeder in the immediate vicinity of its gate aperture.

The invention is described by means of examples in the drawings.

They show:

Fig. 1 – a vertical section through a casting mould.

Fig. 2 – a vertical section through a cylindrical feeder with a breaker core,

Fig. 3 – a magnified illustration of the top view of a breaker core,

Fig.'s 4 to 11 – vertical sections through different breaker cores.

Fig. 1 shows a casting mould **10** with a cope **11** and a drag **12** with the mould cavity **13** into which the molten metal will be filled through a gate **14**. To ensure dense packing of the casting, a feeder **15**, open at its top, and a feeder **16**, which is formed by a preformed feeder **17**, closed at its top, which consists, according to the design example shown, of a preformed body made from an insulating and/or exothermically reacting material, are present. According to **Fig.** 1, breaker cores **18** are present which have in their centre a gate section in the form of a small aperture **19** obtained by stamping it out. By using a stamping process, a sharp edge is produced which helps the separation process.

The knock-off cores **18** consist of a metal plate, 0.2 to 2 mm thick. Their diameters are between 3 and 50 cm.

The gate sections **19** are between 0.5 and 2 cm in diameter, the dimension depending on the diameter of the breaker core. A good value is 0.8 mm.

Fig. 2 shows a cylindrical hollow-bodied feeder **17** made from an exothermically reacting material. Facing the cavity **13**, the iron plate breaker core **18** is located on the lower side of the feeder cavity. On the upper side of the breaker core, or the side facing towards the feeder **17**, a foam plastic layer **20** is placed which ensures that the breaker core can be attached later by means of a press fit by the foam plastic **20** to the feeder **17**. The iron plate breaker core prevents gases from the feeder from entering the molten metal in the actual mould.

Fig. 3 shows notches at the periphery of the breaker core **18** to form bent tabs **21**, **21***a*, **21***b*, which meet the inner wall of the feeder insert **17**, providing the attachment method for the breaker core **18**. This solution ensures that there is no connection between the interior of the feeder and the mould cavity via the inserted notches, but through the gate aperture **19** only.

Fig. 4 shows a flat breaker core **18** with the aperture **19** as the gate section where both are at the same level. The breaker core consists of an unalloyed iron plate with a coat of paint on both sides.

In **Fig.** 5, the gate aperture **19** is at a level above the breaker core **18**. This ensures that, when knocking off the feeder attached to the casting, no harmful recess can remain, as a result of the striking action, in the casting needed later.

Fig. 6 shows that the knock-off core is in the shape of a domed shell. This prevents the feeder "sagging" so that no depression is left on the casting resulting from the feeding. The doming on the breaker core is very slight. It can be changed simply since the sheet metal is easy to deform, making it simple to adapt to the particular requirements.

Fig. 7 shows a breaker core **18** which is provided on both sides with a coating **22**, **22***a* consisting preferably of fireproof, inorganic materials and can, for example, be a layer of enamel. This coating is very thin.

Fig. 8 shows two plates **18** and **18***a*, which are provided with a heat-insulating coating **22**. Additionally, a coating can be applied to the outer sides of the two plates **18**, **18***a*. It is particularly beneficial if the inner coating consists of a plastic film.

The plate **18***a* adjacent to the mould cavity has a raised edge **24** projecting into the gate **19** so that the plastic film **21** cannot come into contact with the molten metal.

Fig. 9 shows a plate **18** which is provided with a plastic foam layer **20**, corresponding to **Fig.** 2, on the side facing the feeder **17**. Furthermore, a thin foam plastic coating **23**, which transforms into lustrous carbon under the effect of the molten metal, is present on the side facing the casting, or mould cavity **13**.

Fig. 10 shows a particularly advantageous solution where the sheet iron breaker core **18** is provided with a fireproof coating **22** on the side facing the casting, or mould cavity **13** and, on the side facing the feeder **17**, with an annular ring of foam plastic **20***a*, the purpose of which is to act as a connecting element to the feeder **17**.

This solution is of particular benefit when used after the production of the mould with mould presses or similar mould-making devices, following which the knock-off core is attached to the feeder insert **17**, in this case using a press fit.

Preferably, the coating in **Fig.** 8 consists of an substance which reacts exothermically with the effect of the heat of the molten metal so that the knock-off core is heated. The outer faces of the plates **18**, **18***a*, are therefore provided with a coating so that the exothermic material cannot affect the molten metal chemically. The exothermic coating **21** can consist of a separate disk.

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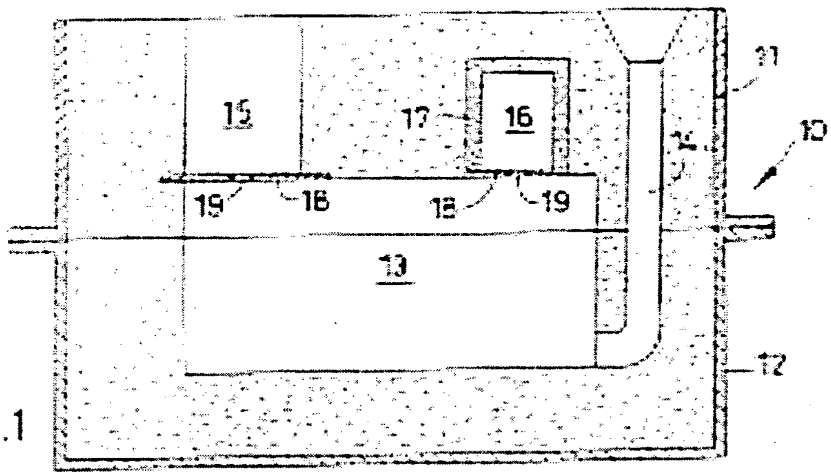

FIG.1

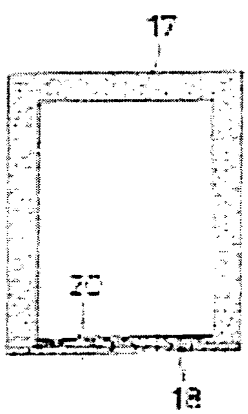

FIG.2

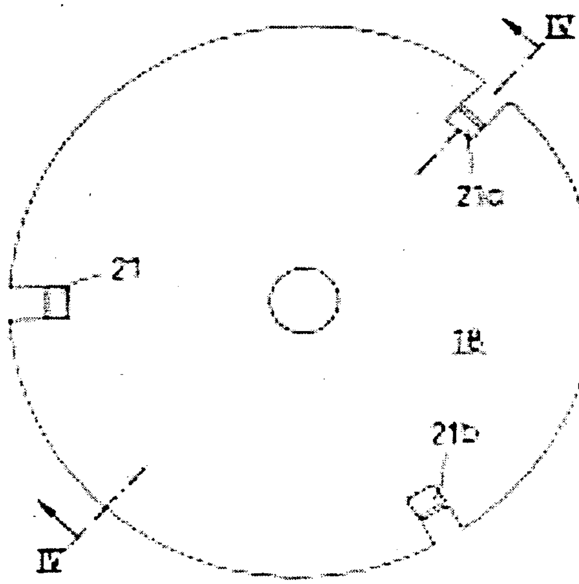

FIG.3

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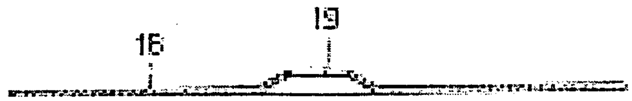
FIG.4


FIG.5


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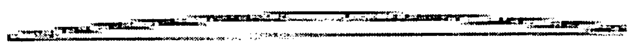


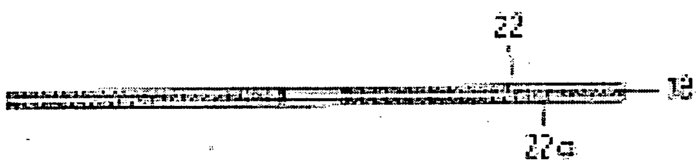
FIG.7


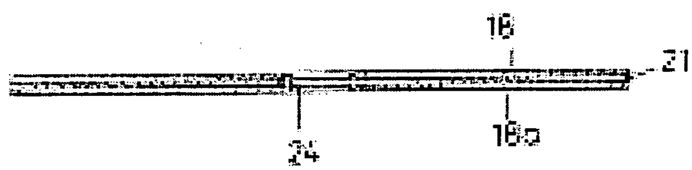
FIG.8


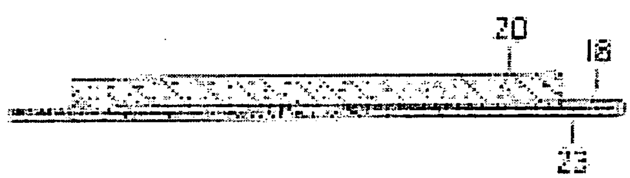
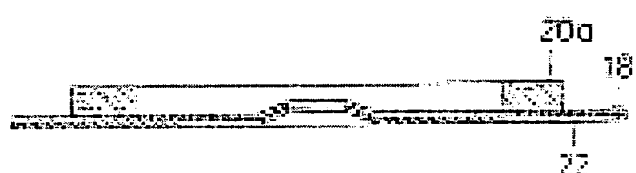
FIG.9


FIG.10


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BEST AVAILABLE